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PROF. ARMSTRONG'S EDUCATIONAL CAMPAIGN.

The Teaching of Scientific Method and other Papers on Education. By Henry E. Armstrong, LL.D., Ph.D., F.R.S. Pp. x+476. (London: Macmillan and Co., Ltd., 1903.) Price 6*s*.

THIS book reproduces the chief contributions which Prof. Armstrong has made to the literature of education from 1884 to the present time, with the addition of a parody by another hand of that most parodied of music hall lyrics, "The Absent Minded Beggar." I have been so constantly in touch with Prof. Armstrong, and occasionally so closely associated with him, that the book comes to me in no degree as a new work, and I have perforce read it from the point of view of one who regards the mode of presentation of the case rather than the merits of the case itself. Though the work is entitled "The Teaching of Scientific Method," its scope is much wider, for it is an indictment of our educational system from top to bottom, and an indication of how education is to be set right in its relation to all the arts of peace and war.

It appears to me that the weakness of Prof. Armstrong's book lies in the want of system and coordination. The arrangement is probably as good as it could be, provided that nothing were feasible but the mere reprinting of twenty-three occasional addresses, but it is impossible not to suppose that the constant reiteration of doctrine, and the continual reappearance of almost the same words, will deter a reader who sits down to read the book solidly through. It would have been a considerable labour, but it would have given unity and plan to the book, if Prof. Armstrong had mixed the twenty-three outpourings, and had subjected the mixed liquid to a process of fractional distillation.

Coming to the matter of the book, it is unnecessary in the pages of NATURE to say a single word in justification of Prof. Armstrong's assertion of the importance of science as an element in national education, and of the importance of teaching science well. I shall confine myself, therefore, to the question as to whether the method of teaching science which Prof. Armstrong advocates is really a way of teaching it well. On this question there is an apparent diversity of opinion among those who may be supposed to be entitled to express an opinion. I will assume no editorial plural in writing on the subject. I, as one teacher, after twenty years' constant study and observation of science teaching in schools am of opinion that Prof. Armstrong is advocating what is essentially a good method, and though I know that this same method has been spoken of by distinguished people in terms of condemnation and ridicule, I am ready to justify my opinion.

The objects of science teaching in schools have been stated again and again in all degrees of fulness and eloquence. They appear different to different people. Science gained a footing in the schools of this country, I think, in the hope that it would prove a bread-and-butter study, and would provide a body of useful information as clearly available for practical purposes as arithmetic. It was an important ingredient of that "modern side" education which was the outcome of a rebellion against the classical basis on which all education had previously rested. It was accepted reluctantly by schoolmasters, who, too ignorant of science to understand its higher possibilities, regarded the intrusion as essentially Philistine in origin and in aim.

In France science was introduced into the school curriculum with a totally different object. The aim there was to add an element of natural philosophy, to open the mind of the young to an appreciation of the grandeur of natural laws, to use science as an element of culture.

My own independent critical knowledge of science teaching in schools does not go back more than twenty years, but I am prepared to maintain that twenty years ago the science teaching that prevailed in this country was in the main execrable. Good teachers there were, no doubt, for good teachers there always will be, independently of all systems. But whether looked at as giving useful information, culture, or mental training, the teaching of science in my school days and after was in the main worthy of the contempt with which it was regarded by all those who had a humane interest in education.

This state of things has now been altered to a degree which makes the change one of the most remarkable and gratifying educational revolutions with which I am acquainted. The change has been wrought by the efforts of a number of men who were sufficiently interested in science and sufficiently imbued with the spirit of the teacher to set to work and show that science could be made an invaluable mind-training study, and among these men I reckon Prof. Armstrong as a potent leader.

Prof. Armstrong renounces the claim, often imputed to him, of having discovered a new method of teaching. What he has done has been to formulate a scheme of teaching in accordance with principles which are almost as old as civilisation. The aim of this scheme has been to free science teaching from the dogmatic didactic methods by which it has been dominated, and to substitute a system which should yield the benefits of the experimental method. Two things, and two things only, I think, are essential to Prof. Armstrong's plan, first, that the pupils should perform experiments with their own hands, and second, that these experiments should not be the mere confirmation of something previously learned on authority, but the means of eliciting something previously unknown or of elucidating something previously uncertain. In this way only, it is maintained, can pupils gain the knowledge and use of scientific method. Incidentally, it is urged that the experimental studies should be made quantitative, and that a small number of problems should be studied thoroughly.

I cannot imagine that this view of the way in which science should be taught can be seriously disputed, and I think it is a pity that so many of Prof. Armstrong's

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critics should have fastened on quite subsidiary matters and left his main contention unacknowledged.

I feel bound to admit that in some respects Prof. Armstrong has overstated his case. His advocacy has suggested that he desires the pupil to discover everything for himself and by himself, and so is incurred the criticism that it is ridiculous to expect a child to achieve in two or three years that which it has taken grown philosophers centuries of labour to achieve. A beginner cannot discover much for himself by himself, but a judicious teacher may lead him to discover much. I think that Prof. Armstrong has exaggerated the importance of quantitative work, great though that importance be. One has only to think of the achievements of Scheele in order to realise what a splendid thing qualitative work may be when faithfully performed. Again, the element of useful information must not be underestimated; we want to get the pupil along, and there is surely much that may be told, if it is properly presented and punctuated with experiments. In doing this there is no need to throw the pupil into a state of passive acceptance, still less of passive resistance; a good teacher knows how to avoid either.

Another point on which Prof Armstrong's critics have fastened is his nomenclature. This is really a trifling matter, but such as it is I am on the side of the critics. " Chalk gas " seems unnecessary, even as a temporary name for carbon dioxide. Why not fixed air, which is both descriptive and historical? However, as I have said, such things are mere trifles.

In conclusion, I will express the opinion that it is not the matter of Prof. Armstrong's proposals that has created opposition, but the manner. There is probably no decent member of society more repugnant to the average Englishman than the aggressive educational reformer. If a man quietly records in books the outcome of his mature reflections and experience—well, you can avoid him by not reading his book, but if he appears at all your meetings with his new doctrines, if he invents new terms that dart promiscuously about the atmosphere of the educational world, and if eventually he gets known to the newspapers as a man likely to furnish occasion for the headline " animated debate," it is quite otherwise. If a man is a stylist like Matthew Arnold, deft with epigram, breathing a cultivated irony, he is forgiven everything for his literary excellence. But Prof. Armstrong has not chosen the persuasive method of Matthew Arnold. He is vigorous almost to violence, red-hot, scathing, scornful, uncompromising and incessant. He is no respecter of persons or institutions, however eminent, however ancient He is absolutely impartial in his iconoclasm.

These peculiarities may have hindered the acceptance of improved methods. In any case, improvement could only have come in slowly, for it is laborious, and taxes the ingenuity as well as the diligence of the teacher. The eagerness of public administrators for speedy results, the false economy which gives the teacher no time to think, and the crowding of elementary classes, not only in the case of science, but all through the school course, are great obstacles to thoroughness. How idle it is to preach improved methods to an overworked teacher who has seventy, eighty or a hundred children to teach at once!

When all reasonable concessions have been made to his critics, it will, I believe, appear that Prof. Armstrong has rendered an inestimable service to the cause of true education. ARTHUR SMITHELLS.

PRACTICAL ZOOLOGY.

First Report on Economic Zoology. By Fred. V. Theobald, M.A. Pp. xxxiv+192; 18 figures. (London: Printed by Order of the Trustees of the British Museum, 1903.) Price 6*s*.

THIS volume of reports on problems of economic zoology is very welcome. It represents a type of publication familiar in America, which has never been more than very rare in Britain; it is packed with valuable practical advice which must surely justify zoology in the eyes of any unconverted utilitarian; and it illustrates the nature and amount of scientific information on matters of economic importance which the staff of the zoological department of the British Museum " is almost daily called upon, and is prepared to furnish to the public service or to individuals." As is well known, this side of the Museum's work has been brought into particular prominence since Prof. Ray Lankester became director.

The contents are necessarily very heterogeneous, and afford a fine illustration of the multitudinous ways in which man's practical interests come into contact with animal life. We find discussions on cereal pests, root-crop pests, fruit pests, garden pests, forest pests, on poison for moles, on tapeworm in sheep, on the origin and varieties of domesticated geese, on dipterous larvæ in human excreta, on *Anobium tesselatum* in St. Albans Cathedral, on green matter in Lewes Public Baths, on the cigar beetle and the Teredo, on the tsetse fly and the Ceylon pearl fisheries, on the screw worm in St. Lucia, locusts in the Sudan, mosquitoes at Blackheath, and so on through a variety of subjects that is positively astounding. Mr. Theobald deserves warm congratulation on the impressiveness of his " First Report."

The variety of subjects which have had to be discussed in response to inquiries from the Board of Agriculture, the Foreign Office, the Colonial Office, and from private individuals makes the volume very multifarious, and gives a special appositeness to Prof. Ray Lankester's introductory scheme or outline of economic zoology. He gives a classified survey of the various subdivisions which it is found convenient to recognise in the treatment of this subject. This classification of animals in their economic relation to man, which recalls a little book by Dr. Edwin Lankester, proceeds from the simpler relations of primitive man and the animals around him to the more complex relations of civilised man with his endless arts and industries and circumscribed conditions. We give the classification in outline:—

Group A.—Animals *captured* or *slaughtered* by man for food, or for the use by him in other ways, of their skin, bone, fat, or other products. *Examples:*—

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